UNITED STATES PATENT AND TRADEMARK OFFICE

9

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/806,710	03/23/2004	Maurice Peter Bianchi	BO1 - 0341US	2668

60483 7590 06/12/2007
LEE & HAYES, PLLC
421 W. RIVERSIDE AVE.
SUITE 500
SPOKANE, WA 99201

EXAMINER	
HALL, ASHA J	

ART UNIT	PAPER NUMBER
1709	

MAIL DATE	DELIVERY MODE
06/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/806,710	**Applicant(s)** BIANCHI, MAURICE PETER	
	Examiner Asha Hall	**Art Unit** 1709	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *See Continuation Sheet*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application.

6) ☐ Other: _____.

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :March 23,2004 and March 6, 2006.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 17 and 18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The applicant does not set forth an electromagnetic radiation range wherein the substrate and conductive coating material is transparent. Also, the applicant fails to disclose which material that is transparent to the entirely to electromagnetic radiation.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

4. Claims 17 and 18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 17 and 18 fails to distinctly point out the electromagnetic radiation range or spectrum of which the substrate and conductive coating is transparent. The examiner

has interpreted the substrate and conductive coating to be transparent in the blue-light emission (380-495nm) of electromagnetic radiation spectrum.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) The invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-5, 7-12, and 15-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Bour (EP 977,279).

In regard to claim 1, Bour discloses a multi-junction solar cell assembly comprising: a transparent substrate/sapphire (405) as shown in Figure 5 (col.7; lines: 32-36); a transparent conductive coating formed on the transparent substrate (405), said transparent conductive coating comprising gallium nitride (410) (col.7; lines: 37-42); a plurality of gallium indium nitride junction layers/quantum well active region (437) formed successively on the transparent conductive coating (col.8; lines: 16-19); and a metallization layer/electrode (450) formed on the plurality of gallium indium nitride junction layers (450, 440, & 435).

With respect to claim 2, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein the transparent substrate is sapphire (405) as shown in Figure 5 (col.7; lines: 32-36).

In regard to claim 3, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, further comprising an indium nitride junction layer (440) formed on the plurality of gallium indium nitride junction layers/quantum well active region (437) between the metallization layer (460) and the plurality of gallium indium nitride junction layers (435) (col.8; lines: 35-39).

With respect to claim 4, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, further comprising a gallium nitride junction layer (430) (col.8; lines: 32-34) formed on the transparent conductive coating (420) between the transparent conductive coating (420) and the plurality of gallium Indium nitride junction layers/quantum well active region (437) (col.8; lines; 7-10).

In regard to claim 5, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein each layer of the plurality of gallium indium nitride junction layers has a thickness of 1.0 microns (col.8; lines: 15-16).

In regard to claim 7, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein each layer of the plurality of gallium indium nitride junction layers has a gallium content of about 70 wt% and an indium content of 30 wt% (col.3; lines: 9-14).

With respect to claim 8, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein each successive layer of the plurality of gallium indium nitride junction layers has a gallium content less than the immediately preceding layer of the plurality of gallium indium nitride junction layers and an indium content

greater than the immediately preceding layer of the plurality of gallium indium nitride junction layers (col.10; lines: 7-13).

In regard to claim 9, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein each layer of the plurality of gallium indium nitride junction layers has a band gap of 2.7eV (col.3; lines: 5-7).

With respect to claim 10, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein each successive layer of the plurality of gallium indium nitride junction layers has a band gap less than the band gap of the immediately preceding layer of the plurality of gallium indium nitride junction layers (col.3; lines: 5-13). Bour teaches that GaN is 3.4eV and InN is 1.9eV, and in order to obtain the band gap around 2.7eV, the In content needs to be 50%. Thereby teaching that as the In content decreases or increases so does the band gap energy (col.3; lines: 19-25).

In regard to claim 11, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein the transparent conductive coating comprises: a nucleation layer/buffer layer (310) formed on the transparent substrate; a lateral epitaxial overgrowth layer of gallium nitride formed nucleation layer (col.5; lines: 40-55); and a defect-free gallium nitride layer formed on the lateral epitaxial overgrowth layer (col.6; lines: 1-6).

With respect to claim 12, Bour discloses a multi-junction solar cell assembly in accordance with claim 11 above, wherein the nucleation layer/buffer comprises: an aluminum nitride coating formed directly on the transparent substrate in intimate contact

with the transparent substrate; and a seed layer of gallium nitride formed on the aluminum nitride coating (col.6; lines: 1-6).

In regard to claim 15, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein the transparent conductive coating comprises a gallium nitride layer (410) as shown in Figure 5 formed on the transparent substrate (col.5; lines: 40-55).

With respect to claim 16, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, further comprising a metal current collector bus/electrode (460, 470 or 360,370) for receiving electrical power collected from the plurality of gallium indium nitride junction layers by the transparent conductive coating (col.6; lines: 55-58).

In regard to claim 17, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein said transparent substrate (405) /sapphire is entirely transparent to visible light/electromagnetic radiation (col.5; lines; 35-37).

With respect to claim 18, Bour discloses a multi-junction solar cell assembly in accordance with claim 1, wherein said transparent conductive coating (col.5; lines: 44-45) is entirely transparent to violet-blue light/electromagnetic radiation (col.3; lines: 26-35).

In regard to claim 19, Bour discloses a multi-junction solar cell assembly comprising: a transparent substrate/sapphire (405) as shown in Figure 5 (col.7; lines: 32-36); a transparent conductive coating formed on the transparent substrate (405), said transparent conductive coating comprising gallium nitride (410) (col.7; lines: 37-42);

a plurality of gallium indium nitride junction layers/quantum well active region (437) formed successively on the transparent conductive coating (col.8; lines: 16-19); and a metallization layer/electrode (450) formed on the plurality of gallium indium nitride junction layers (450, 440, & 435).

In regard to claim 20, Bour discloses a method as applied to claim 19 above, further comprising an indium nitride junction layer (440) formed on the plurality of gallium indium nitride junction layers/quantum well active region (437) between the metallization layer (460) and the plurality of gallium indium nitride junction layers (435) (col.8; lines: 35-39).

With respect to claim 21, Bour discloses a method as applied to claim 19 above, further comprising a gallium nitride junction layer (430) (col.8; lines: 32-34) formed on the transparent conductive coating (420) between the transparent conductive coating (420) and the plurality of gallium Indium nitride junction layers/quantum well active region (437) (col.8; lines; 7-10).

In regard to claim 22, Bour discloses a solar cell assembly comprising: a transparent substrate/sapphire (405) as shown in Figure 4 (col.7; lines: 32-36); a transparent conductive coating formed on the transparent substrate (405), said transparent conductive coating comprising gallium nitride (410) (col.7; lines: 37-42); a plurality of gallium indium nitride junction layers/quantum well active region (437) formed successively on the transparent conductive coating (col.8; lines: 16-19); and a metallization layer/electrode (450) formed on the plurality of gallium indium nitride junction layers (450, 440, & 435).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 6, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bour (EP 977,279) in view of Schetzina (6,046,464).

With respect to claim 6, Bour discloses a multi-junction solar cell assembly in accordance with claim 1 (Figure 5), but fails to discloses wherein each successive layer of the plurality of gallium indium nitride junction layers (437) has a thickness greater than a thickness of the immediately preceding layer of the plurality of gallium indium nitride junction layers (437).

Schetzina discloses a multiple quantum well semiconductor material composed of InGaN and GaN layers (col.10; lines: 36-40) and further discloses wherein each successive layer of the plurality of gallium indium nitride junction layers has a thickness greater than a thickness of the immediately preceding layer (col.7; lines: 44-49). Also, Schetzina teaches that the layers in the multiple quantum well (MQW) are graded (thickness is increased) to serve as low resistance electronic links (provide an ohmic contact) between the layers and the electrode and to the semiconductor device itself, thereby increasing the performance and efficiency (col.10; lines: 51-56). It would have been obvious to one skilled in the art at the time of the invention to apply the graded

(increasing thickness) of the layers MQW of Schetzina to the semiconductor device of Bour, in order to increase the performance and efficiency of the device.

In regard to claim 13, Bour discloses a multi-junction solar cell assembly in accordance with claim 1 (Figure 5), but fails to discloses a multi-junction solar cell assembly in accordance with claim 1, wherein the transparent conductive coating comprises: a plurality of alternating layers of gallium nitride and aluminum gallium nitride; and a plurality of quantum wells, each quantum well of the plurality of quantum wells formed at a corresponding interface between adjacent layers of gallium nitride and aluminum gallium nitride of the plurality of alternating layers of gallium nitride and aluminum gallium nitride.

Schetzina discloses multiple quantum well semiconductor material composed of InGaN and GaN layers as shown in Figures 9A-9C (col.10; lines: 36-40), and further discloses the transparent conductive coating comprises: a plurality of alternating layers of gallium nitride and aluminum gallium nitride (Figure 5); and a plurality of quantum wells (222b), each quantum well of the plurality of quantum wells formed at a corresponding interface between adjacent layers of gallium nitride and aluminum gallium nitride of the plurality of alternating layers of gallium nitride and aluminum gallium nitride (Figure 6A). Schetzina teaches that the energy barrier (conduction band offset) between the conduction bands can be eliminated by adding an intermediate layers that are doped and continuously graded to maintain an equilibrium Fermi energy level throughout the structure, thereby providing for a suitable ohmic contact (col. 13; lines: 1-17 and col.5; lines: 48-55). It would have been obvious to one skilled in the art

at the time of the invention to apply the alternating layers of GaN and AlGaN of Schetzina to the semiconductor device of Bour, in order to eliminate the conduction band offset thereby creating a better ohmic contact within the device.

With respect to claim 14, Bour discloses a multi-junction solar cell assembly as applied to claim 13 above, wherein a first gallium indium nitride junction layer (InGaN) of the plurality of gallium indium nitride (InGaN) (435) junction layers is formed directly on a last gallium nitride layer (GaN) (430) (col.10; lines: 7-8). Bour fails to disclose the plurality of alternating layers of gallium nitride (GaN) and aluminum gallium nitride (AlGaN) in intimate contact with a plurality of InGaN layers.

Schetzina discloses multiple quantum well semiconductor material composed of InGaN and GaN layers as shown in Figures 9A-9C (col.10; lines: 36-40), and further discloses the plurality of alternating layers of gallium nitride and aluminum gallium nitride in intimate contact with the last gallium nitride layer of the plurality of alternating layers of gallium nitride and aluminum gallium nitride (Figure 5). Schetzina teaches that the energy barrier (conduction band offset) between the conduction bands of AlGaN and GaN in the multiple quantum wells (MQW) can be eliminated by adding an intermediate layers that are doped and continuously graded to maintain an equilibrium Fermi energy level throughout the structure, thereby providing for a better ohmic contact (col. 13; lines: 1-17). It would have been obvious to one skilled in the art at the time of the invention to apply the alternating layers of GaN and AlGaN of Schetzina applied to the multiple quantum wells of InGaN of Bour, in order to eliminate the conduction band offset thereby creating a better ohmic contact within the device.

5. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takayama et al. (6,521,917) in view of Bour (EP 977,279).

With respect to claim 23, Takayama et al. discloses multi-junction solar cell assembly comprising: a substrate (100) having a first side and a second side opposite the first side; a metallization layer/electrode (140) formed on the first side of the substrate; a collector grid/cladding layer (105) formed on the second side of the substrate; a plurality of gallium indium nitride junction layers formed successively on the collector grid/cladding layer (105); and a glass cover/SiO2 (135) on the plurality of multiple quantum wells as shown in Figure 7E.

Takayama et al. fails to disclose that the multiple quantum wells are composed of gallium indium nitride layers. Bour discloses semiconductor device comprising: a transparent substrate/sapphire (405) as shown in Figure 4 (col.7; lines: 32-36); a transparent conductive coating formed on the transparent substrate (405), said transparent conductive coating comprising gallium nitride (410) (col.7; lines: 37-42); a plurality of gallium indium nitride junction layers/quantum well active region (437) formed successively on the transparent conductive coating (col.8; lines: 16-19); and a metallization layer/electrode (450) formed on the plurality of gallium indium nitride junction layers (450) thru (435). Bour teaches that InGaN alloys span the visible spectrum, which will produce light in the blue region of the spectrum (col.7; lines: 7-13). It would have been obvious to one skilled in the art at the time of the invention to apply

InGaN layers MQW of Bour to the semiconductor device of Takayama et al., in order to span the visible spectrum, which will produce light in the blue region of the spectrum.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asha Hall whose telephone number is 571-272-9812. The examiner can normally be reached on Monday-Friday 7:30-5:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571-272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AJH
AJH

Alexa Neckel
ALEXA D. NECKEL
SUPERVISORY PATENT EXAMINER